WMo-Skarn From the Mraconia Valley, Romania

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W-Mo Skarn From the Mraconia Valley, Romania

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Abstract. The skarn from the Mraconia was formed at the contact between crystalline limestone of the Neamtu Series and a porphyritic granodiorite. The main metallic minerals in the Mraconia Valley are scheelite and molybdenite. The skarn mainly consists of garnet (andradite), ferro-actinolite, magnetite, epidote, apatite, vesuvianite and wollastonite. Four stages of mineralization overprint the primary skarn: (a) a high temperature stage, consists of the deposition of scheelite as impregnations in the mass of andraditic skarn and a simultaneous deposition of the classical ”quartz-molybdenum” ore along the cracks in granodiorite mass; (b) the hydrothermal stage which overprinted the first event, conducing to the deposition of pyrite, chalcopyrite and calcite along the cracks and leading to the impregnation of the skarn mass by pyrite and chalcopyrite; (c) the second hydrothermal stage conduced to the deposition of massive mineralization of chalcopyrite, pyrite, sphalerite and galena, while scarce pyrrhotite and tertahedrite mineralization formed veins and lenses in the skarn mass; (d) a low temperature hydrothermal stage yielded the depositions of bornite and covellite on chalcopyrite and hematite (specularite) on magnetite. The endoskarns are characterized by the presence of sulfides of Mo, Pb, Cu, Zn and the exoskarns are much richer in scheelite.

Key words: exoskarn, endoskarn, scheelite, molybdenite, Mraconia, Romania.

Introduction

The research area overlaps with the hydrographic basin of the Mraconia Valley. It is bounded by the the Poiana Mraconia and Lugojistea at north, the Satului Valley at east, the Ponicova Valley at south, and the Cracul Radului–Cracul Urzicea at west. The skarn was described for the first time by the STRECKEISAN (1934) within the Catramat Series with a depth gradient of catazonal to mesozonal. This series represents the debris of an old unit of Upper Carboniferous age.

In this study, we present our results of the petrological investigations and give the mineralization sequences related to the skarn formation.

Geology of the skarn area

The crystalline schist of the Poiana Mraconia Series (CODARCEA *et al*., 1934) suffered a progressive metamorphism to the amphibolite with almandine facies and the kyanite-almandine-muscovite sub-facies. It associates with the meta-pelite paragenesis including kyanite, green hornblende, andesine and almandine. The primary metamorphism was followed to the regressive metamorphism by the Assyntic orogeny and Varisc cycles (BERCIA & BERCIA, 1975). The amphibolite paragneiss and the micas paragneiss (with biotite and garnet) associated with the quartz-feldspar gneiss were affected by the arteritic migmatization.

The studied skarn was formed along the contact between crystalline limestone of the Neamtu Series and a porphyritic granodiorite of probably Triassic age (VLAD *et al*., 1984). The magmatic rocks belong to the two generations of intrusions corresponding to the acid magmatic phase, followed by the dykes including kersantite and spessartite, respectively. The granitoids of the Mraconia valley are holocrystalline and hipidiomorphes, and their structure and texture are inetergranulare.

Skarn mineralogy

The W-Mo skarns, result of metasomatism of the adjacent formations due to magmatism from the Poiana

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Mraconia, have been found in the upper basin profile of the Ponicova, Mraconia and Soblanului Valleys. There are two types of skarns: exoskarns were formed on the limestone and hornfels calcic, and endoskarns came from the transformation of igneous rocks.

The endoskarns have a complex mineralogy; the pyroxenes are transformed into ferro-actinolite, clinozoisite, magnetite and quartz. Into this contact zone, important quartz vein occurs containing sulfides: pyrite, chalcopyrite, sphalerite, and galena and in some cases, the important molybdenite-quartz mineralization (Fig. 1 left).

Fig. 1. Molybdenite-bearing skarn with mineralization.

The exoskarns were developed on limestones and hornfels. The exoskarns of limestone are composed of garnet (andradite), clinopyroxene and some of wollastonite. Scheelite is mainly present in veins and associates with calcite (Fig. 1). The exoskarns on limestone contain pyrite late. The exoskarns on hornfels show a significant occurrence of sulfides, chloritization of biotite and the presence of magnetite.

Skarn Geochemistry

The endoskarns can be distinguished by their higher contents of Al, Na, K, Fe, Mg, Mn, Cu, Pb and Mo, while, the exoskarns are characterized by their high content of W. Thus, we have noticed a duality related to substratum (limestone, hornfels, granitoids) through which the metasomatic fluids.

Fig. 2. Scheelite skarn with quartz mineralized in the right.

The skarns in the systems ACF and CaO–SiO_2–MgO (Figs. 2, 3 and 4) show clearly the difference between endoskarns and exoskarns, and the influence of the crystallization of garnet and pyroxene on the evolution of fluids between the igneous rocks and limestones. Some exoskarns show the presence of

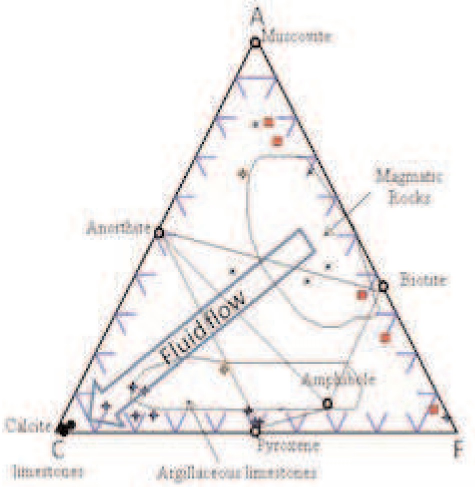

Fig. 3. Distribution of chemical composition of exoskarns and endoskarn in Ternary diagram A–C–F A (Al_2O_3+Na_2O+K_2O) – C (CaO) – F (Mgo+Fe_2O_3+MnO). The circled areas represent the magmatic rocks of the region and argillaceous limestones.

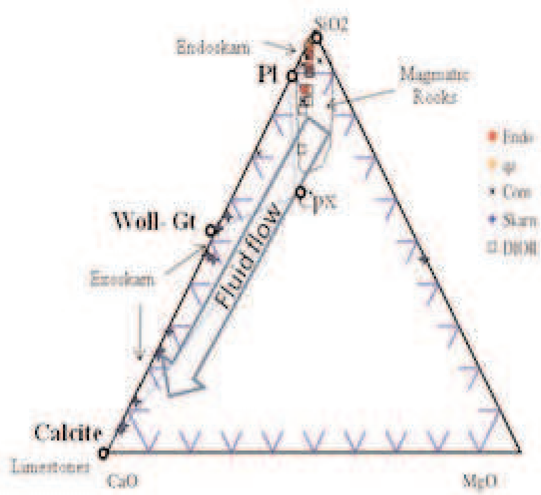

Fig. 4. Distribution of chemical composition of exoskarns and endoskarns in Ternary diagram CaO–SiO_2–MgO. The circled areas represent the magmatic rocks of the region and limestones.

wollastonite in this equilibrium. Finally endoskarns are characterized by the presence of sulfides of Mo, Pb, Cu, Zn; the other hand, the exoskarns are much richer in scheelite (Fig. 5).

The Garnet is contemporary with sulfide phase affecting the pyroxene. There has been a syn-crystallization of andradite and sulfides, and silicification associated with sulfides (pyrite, pyrrhotite). The assemblage andradite-quartz-sulfide results from the transformation of pyroxene in the presence of sulfide phase. If the fugacity of sulfur increases during the transformation, the pyrrhotite is unstable and only pyrite is present.

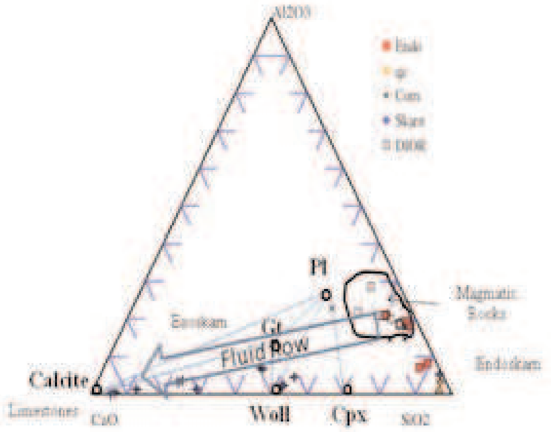

Fig. 5. Distribution of chemical composition of exoskarns and endoskarn in Ternary diagram SiO_2–Al_2O_3–CaO. The circled areas represent the magmatic rocks of the region and limestones.

Conclusions

The skarn from the Mraconia was devoled at the contact between crystalline limestone of the Neamtu Series and a porphyritic granodiorite probably Triassic or Upper Cretaceous age. The main metallic minerals from Mraconia Valley are scheelite molybdenite. The skarn is richer in garnet (andradite), ferroactinolite, magnetite, epidote, apatite, vesuvianite and wollastonite. Four stages of mineralization overprinted the primary skarn:

1 - a high temperature stage, consists of the depositions of scheelite as impregnations in the andraditic skarn and a parallel deposition of the quartz-molybdeniteore along the cracks of granodiorite;

2 - the hydrothermal stage which overprinted the first event, conducing to deposition of pyrite, chalcopyrite and calcite on the cracks and of impregnations of pyrite and chalcopyrite in the skarn;

3 - the second hydrothermal stage conduced to the massive deposits of the chalcopyrite, pyrite, sphalerite, galena, pyrrhotite and tertahedrite, which forms veins and lenses in the skarn;

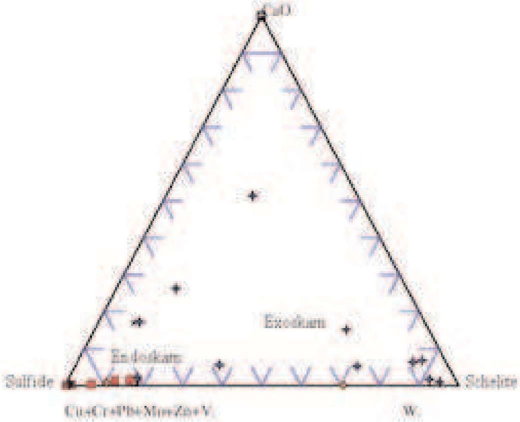

Fig. 6. Distribution of skarn and endoskarn in Ternary diagram W–CaO–(Cu+Mo+Cr+Zn+V).

4 - a low temperature hydrothermal stage yielded the formations of bornite and covellite on chalcopyrite but also of hematite (specularite) on magnetite.

The endoskarns and exoskarns on hornfels are characterized by the presence of sulfides of Mo, Pb, Cu, Zn and the exoskarns on limestones are much richer in scheelite.

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